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THE LITERATURE ON LANGUAGE ABILITY AND ITS RELATIONSHIP TO ACADEMIC SUCCESS INCREASINGLY VOICES ALARM THAT THE CULTURALLY DISADVANTAGED ARE SERIOUSLY DEFICIENT IN LANGUAGE ABILITY. INTERVENTION PROGRAMS CREATED TO CORRECT THIS PROBLEM ALL RECOGNIZE THE IMPORTANCE OF LANGUAGE TOOLS FOR INTELLECTUAL FUNCTIONING. ESSENTIAL TO SUCH PROGRAMS, AND FREQUENTLY ABSENT FROM THEM, ARE RELIABLE MEASUREMENT TECHNIQUES FOR EVALUATING THE INTERACTION OF THE PROGRAM WITH THE CHILD'S COGNITIVE PROCESSES. THE PRESCHOOL LANGUAGE PROJECT AT THE UNIVERSITY OF CALIFORNIA AT LOS ANGELES IS CONSTRUCTING AND USING NEW MEASURING DEVICES--FOR EXAMPLE, THE VISUAL DISCRIMINATION INVENTORY (VDI). THE VDI WAS ADMINISTERED TO 291 PRESCHOOL CHILDREN TO OBTAIN DATA ON THE VISUAL DISCRIMINATION ABILITY OF THE 199 NEGRO AND 92 CAUCASIAN CHILDREN. THE CHILDREN REPRESENTED TWO LEVELS OF ECONOMIC STATUS AND RANGED IN AGE FROM 3 TO ALMOST 6. ADMINISTRATION OF THE VDI INVOLVED PRESENTING THE CHILD WITH A MODEL FIGURE AND THREE CHOICE FIGURES FROM WHICH TO SELECT THE ONE THAT MATCHED THE MODEL. AGE AND RACE APPEAR TO BE RELATED TO DISCRIMINATION ABILITY. THE VDI WAS FOUND TO HAVE BOTH RELIABILITY AND VALIDITY. THIS DOCUMENT IS COMPOSED OF TWO REPORTS. ONE WAS PRESENTED AT THE BIENNIAL MEETING OF THE SOCIETY FOR RESEARCH IN CHILD DEVELOPMENT (NEW YORK, APRIL, 1967) AND THE OTHER, AT THE AMERICAN PSYCHOLOGICAL ASSOCIATION ANNUAL MEETING (WASHINGTON, SEPTEMBER, 1967). (WD)

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APPENDIX I

to the

ANNUAL REPORT

November, 1967

Two Papers Presented at Professional Meetings

Reporting Research at the

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Evaluating Language Curricula for Preschool Disadvantaged Children[1,2]

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There are some linguists who maintain that children from culturally-disadvantaged homes are not, per se, language handicapped; that they have a functionally complete, although perhaps different, language system of their own. Whether or not this is true from a linguistic point of view is relatively immaterial to educators who are faced with the high incidence of school failure among these "linguistically-different" children. There is no doubt that in almost every measure of verbal ability, visual and auditory discrimination, and other cognitive and perceptual skills closely related to successful performance in academic tasks, children from the "culture of poverty" score significantly below those from middle-class homes.

Herbert Birch (1967) called attention to the danger of drawing inferences of causality from correlational data. Because a set of variables can be shown to covary in a dependable relationship under a given set of circumstances does not necessarily mean that the modification of one will produce a predictable change in the other. Edward Gordon (1965) has pointed out that correlational studies offer no guidelines for planning interference procedures and may be harmful in that they provide a spurious statistical basis for a popular mythology. However, the evidence from psychological studies convincingly demonstrates that the ability to perform logical operations, reason inferentially, and extract generalizations from the abstract manipulation of experience is intrinsically tied to the mediational function of language.

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The consistent findings, from experiments throughout this country as well as in other countries (e.g. Israel), that language deficits characterize children from low-income homes, and that the deficits are greatest in those uses of language most closely related to cognitive behavior, have led to what amounts to a revolution in early childhood education. Five or ten years ago, the nursery school teacher would have been highly resistant to the inclusion of systematic language development in her curriculum. She was much more concerned with block play, arts and crafts, and music and rhythms, all of which activities were used to provide opportunities for developing that ultimate desideratum: socialization. Contrast this with a recent survey in which 119 Headstart and Day Care teachers selected additional course work in "developing language skills" most frequently as either the first, second, or third choice from a list of 25 possible training courses (Gordon, 1966). Contrast this also with the rash of language-based compensatory preschool programs, ranging from the complex capacities of the quarter-of-a-million-dollar Edison Responsive Environment (more popularly known as the "talking typewriter") to equally revolutionary procedures with less expensive materials and equipment.

These intervention programs may be conceived as lying along a continuum defined in terms of structure. The Bereiter-Engelmann (1966) program described by Jean Osborn (1967) would be at one end of the distribution, that of Pat Minuchin and Barbara Biber (1967) at the other. In the first, the position is that language deficiences can best be compensated by a systematically-structured program which emphasizes patterned repetition and drill. Based on "logical rather than linguistic analogies," it conceives language as the "vehicle for teaching of concepts and the rules for manipulation of concepts" and does not concern itself with the "social and expressive uses" of language.

The developmental approach sees language as but one aspect of the child's growth pattern. Because it is considered to be dependent upon many non-verbal factors, with important emotional and psychological components, the language program is placed within the total experiential context.

Between these two positions are the approaches used by Susan Gray (Gray and Klaus, 1966) at Peabody, David Weikart (1966) at Ypsilanti, Walter Hodges (Hodges, Stearns, and Spicker, 1966) at Indiana, and Allan Hartman (1966) in Harrisburg, Pennsylvania, to name but a few. The materials used by Larry Gotkin (1965, 1967) are part of a comprehensive and many-faceted program which the Institute for Developmental Studies is carrying out in New York City. Finally, Project Headstart has put preschool intervention on a national basis.

Throughout all of these programs, in some more explicitly than others, there is an awareness that language is the key to unlock the child's ability to learn. The more complex and varied the language tools the child is capable of manipulating, the greater will be his control over those basic cognitive processes which are prerequisite to the type of intellectual functioning which leads to school success. (Cf. Bernstein, 1964; Carroll, 1964; John and Goldstein, 1964; Barbara Gordon, 1965, to select a few of the earlier articles from what has now become a voluminous literature.)

There is usually some provision for measuring the effectiveness of the behavioral changes which are presumed to occur as a result of a particular program. In most cases the instruments used are selected from existing standardized tests. Among the most frequently used for such pre- and posttests are the Stanford-Binet, Peabody Picture Vocabulary, Goodenough Draw-A-Man, and the Illinois Test of Psycholinguistic Ability. The Institute for Developmental Studies has undertaken the construction of new instruments for use with disadvantaged children. The

Reading Prognosis Test (Feldmann and Weiner, 1962), the Standard Telephone Interview (Gotkin, et al., 1964), the Story Re-telling Technique (John and Berney, 1967) and the Children's Language Sample (Scher and Horner, 1967), are attempts in one way or another to evaluate children's language in naturalistic settings, thus avoiding the criticisms (cf. Salzinger, 1967) that ratings based on single-word vocabulary tests do not present a meaningful picture of verbal facility. Unfortunately, however, there is no simple, objective procedure for scoring or categorizing the tremendous corpus of children's language which can be quickly and economically collected by these techniques. The hundreds of hours of listening, by trained phoneticians, to many repetitions of the taped interviews, the necessity to obtain some degree of consensus from several judges for each speech sample, and the difficulties in rating the transcribed utterances, make these procedures inappropriate for a testing instrument to be used with a large population.

Basically, the problem of evaluating any specific program is often confounded by a lack of explicitly stated behavioral objectives. In some cases where the objectives are explicated, there is a lack of correspondence between the stated goals and the instruments used to evaluate the terminal behavior. It is obvious that evaluation instruments must be designed so as to measure the effectiveness of a particular procedure in accomplishing what it sets out as its goals. However, there is the far more fundamental problem of determining the rationale which sets these immediate objectives within the framework of the long-range goals of intervention and innovation in education.

Probably the most prevalent, and most often left implicit, goal of a language remediation program is that of imposing middle-class speech patterns, even if only as a "second language," on children who use dialect speech. Here the

major emphasis is on the social values of "good" English. The argument for this objective is that standard English is an essential ingredient in effective cognitive functioning.

Closely related to both of these purposes is that of raising scores on intelligence tests. While the correlation between intelligence and academic success is well established, the meaningfulness of I.Q. scores for this population when obtained with existing instruments is open to question. Glick (1966) has pointed out the fallacy of first interpreting performance on intelligence tests as reflecting underlying cognitive structures, and then inferring from improvement in scores on these tests that fundamental changes in cognitive structures have occurred as the result of the intervention activity. The implied distinction between performance and innate ability is highly reminiscent of the performance-competence controversy which has raised the blood pressure and temperature of linguists and psycholinguists. For the product-oriented researcher who is intent on producing specific and measurable behavioral changes in disadvantaged children, the fine points of this argument are of little practical value. Even if all an intervention program does is teach these children how to "play the game" and motivate them so that they do become successful competitors in the academic arena, the program has had an obvious and important beneficial effect.

Unfortunately, it is especially difficult to establish that a particular type of instructional sequence has achieved the objective of preparing a child for continuing success in school tasks. This type of evidence can only be gained from longitudinal studies in which appropriate curricula are presented over several years of schooling. It is patently absurd to imply that a compen-

satory program has been a failure because initial gains are dissipated when the child is placed in an inadequate primary curriculum. The position of this paper is that any number of approaches to language development are permissible and valid as long as the stated outcomes of the program can be demonstrated in overt and measurable behavior.

At UCLA, the Preschool Language Project has accepted as expedient the objectives of teaching children to use standard English both as a tool with which to control their environment more effectively, and as a conceptual system with which to process information, perceive relationships, and perform logical operations. There is the collateral expectation that I.Q. scores will show increases, along with improvement in school performance, maintained through the first grade.

The program provides for two types of evaluation: summative and formative (Scriven, 1965). The former looks primarily at the terminal behavior, the latter is the ongoing process which tests each phase of the instructional program while it is being developed. For the first type of evaluation, two traditional instruments are being used, the Peabody Picture Vocabulary Test and the Goodenough Draw-A-Man Test. In addition, several new instruments are being constructed.

The first of these is a measure of auditory discrimination which avoids a critical weakness in existing instruments of this type. In many tests, the child's ability to discriminate sounds is measured in terms of how well he can classify pairs of auditory stimuli as either the "same" or "different." Culturally-disadvantaged preschool children find this task very difficult. A test which involves the comparator function will have low validity insofar as scores reflect the child's level of ability to understand the instructions rather than to discriminate the stimuli.

The Children's Auditory Discrimination Inventory (CADI) uses 38 pairs of pictures. One of each pair represents a familiar object, called by its appropriate label; the other is a nonsense picture to which a nonsense disyllable has been arbitrarily assigned. The child is told the names of the pictures by the examiner, and then given the stimulus to which he is to respond. For example the sample item in Figure 1, "This is a table and this is a pable. Put

INSERT FIGURE 1 ABOUT HERE

your finger on the pable." On the whole, an equal number of real and nonsense words are called for, but in random order.

The words selected were based on a hierarchy of difficulty of phonemic contrasts, ranging from exceedingly gross discriminations (e.g. girl - hujuj) to minimal pairs (e.g. fish - fith). The real words and pictures have been pretested with a comparable population and found to be well within the children's response repertoire. The nonsense stimuli were selected from those rated low in association value in a study with a similar population.

A second instrument, the Visual Discrimination Inventory (VDI), is concerned with the assessment of the child's ability to discriminate visual stimuli. Most available tests of this skill require the child to produce a written response which usually demands a high order of motor control. Again, the measure of discrimination is confounded with the irrelevant characteristics of the response mode. To provide a more valid test of discrimination, the VDI requires the child to indicate his ability to discriminate forms by making a simple selection response. The four areas under which the tasks are subsumed are: form constancy, figure-ground, closure, and position-in-space. (See Figure 2) There are 52 items in the test, which takes approximately ten minutes.

INSERT FIGURE 2 ABOUT HERE

Before the test is administered, a preliminary training sequence provides familiarization with the selection task. The children are taught to match one of three pictures with a model, using familiar objects such as a cat, a ball, and a bat. Only after ten correct selections in a row have been made is the child given the actual test items.

These two tests are included in our evaluation battery because there is a pervasive belief, based on what may be termed a commonsense validity, that the way children discriminate sounds and forms is closely related to the acquisition of reading skills. While there is ample correlational evidence that good readers are more apt to be good discriminators and poor readers poor discriminators, there have been no successful experiments to demonstrate that improving performance in discrimination will also improve performance in reading. After sufficient normative data have been gathered, and the reliability of the instruments established, a number of experiments will be designed to test the hypothetical relationship between beginning reading and auditory and visual discrimination.

The instrumental use of language is most clearly demonstrated in its expressive function. At the simplest level of complexity is echoic responding or imitative behavior. A mynah bird or a parrot is capable of this type of production. However, it can be assumed that the ease with which an utterance can be produced is a function of the degree of familiarity the responder has with the particular chain of verbal stimuli. Thus it may be much easier for an adult to repeat a long sentence in his native language than a short phrase in an unfamiliar one. To obtain a measure of the child's range of sentence complex-

ity, the Echoic Response Inventory for Children (ERIC) presents a sequence of 20 sentences,, differing in length and transformational difficulty. The first few sentences are short, such as "Dogs bark." or "Babies drink milk." A more difficult sentence would be "If it's late I have to hurry." A sheet with all the sentences written out is marked by the examiner to indicate any deviations from the stimulus sentence. (See Table 1 for sample sentences.) This is kept

INSERT TABLE 1 ABOUT HERE

as a record of the child's performance. It can be compared with his performance at a later date to obtain an objective measure of change in behavior over time, with and without intervention procedures.

While there has been increasing criticism of the use of vocabulary as an index of verbal facility, the fact remains that performance on vocabulary tests is still used as the major criterion for selection for college (College Entrance Examination) and even graduate school (Graduate Record Examination). The Peabody Picture Vocabulary has been widely used in evaluating the effects of compensatory preschool programs. However, it covers a wide range of mental ability, and perforce provides only a small sample of words for the young child. Also, it does not require the child to produce the word, only to select, out of four pictures, the one with which it is associated. The Expressive Vocabulary Inventory (EVI), developed for the Preschool Language Program battery, differs in both these respects. First, it includes 40 items, selected from a list of words obtained in a field test to determine the vocabulary children are expected to possess when they enter kindergarten. By providing a larger number of suitable items, it should be a more reliable instrument for this age group. Secondly, the response required from the child is not a pointing or selection response but a verbal one. Whereas most vocabulary tests are heavily weighted with nouns,

the stimuli in the EVI represent a variety of parts of speech. There are progressive verb forms, prepositions, adjectives, and adverbs, as well as verbs and nouns. For instance, the child is shown a picture of a boy swimming, and is asked, "What's the boy doing?" Credit is given only if the -ing form is used. Another picture shows a cat in a box, with the question: "Where's the cat?" The child gets credit only if he uses the appropriate preposition. (See Table 2 for sample items.)

INSERT TABLE 2 ABOUT HERE

Two additional tests are being developed to get at larger samples of childrens' speech. The first is a semi-structured Verbal Output Inventory. In this instrument, children are shown five black-and-white line drawings, one at a time. There are two country scenes, a middle-class urban scene, an urban slum street scene, and a picture of a typical zoo. For each scene, the children are given a five second interval to simply look at the picture. Then they are instructed to name as many things as they can. When they have stopped labeling, they are asked to tell what is happening in the picture. Finally, they are encouraged to imagine what is going to happen next. (See Figure 3 for sample items.)

INSERT FIGURE 3 ABOUT HERE

The second language sample is obtained from a Structured Story-Telling Test which requires the child to produce his own story on the basis of pictorial stimuli. For the first story, the child is shown two separate black-and-white line drawings. In the first picture, a boy is flying a kite. In the second picture, the same boy is standing and watching the kite flying away. The child is asked to look at both pictures (the examiner indicates by pointing to each picture consecutively) and to tell a story about them. The second story has

three separate pictorial stimuli which tell a similarly simple and familiar story. The scoring system for this task is still in the process of revision, but there will undoubtedly be some credit assigned for recognition of story continuity.

Another series of tests, the Language Comprehension Inventory, attempts to evaluate the child's ability to respond appropriately to the verbalizations of others. A subtest aimed at measuring ability to respond to prepositions requires the child to place a checker in the appropriate relationship to a small box (in, on, behind, etc.) or two boxes (between). Another subtest provides the child with a booklet, each page of which consists of a model and two or three alternatives. The child is asked to look at the model and then mark the picture which is exactly like it.

Verbal mediation may well be considered the highest level of language usage. The way children use their own language to help them solve problems, as well as their ability to cope with those simple logical operations controlled by sentential connectives such as "both - and", "either - or", and "not" are tested in a series of subtests involving conjunction, disjunction, and negation. Children are also tested on their ability to draw inferences and solve problems on the basis of data which they are given.

This battery of evaluation instruments is designed to assess the child's ability to use language in expressive, receptive, and mediational tasks. Designed as pre- and posttests for the Preschool Language Program, they are not intended specifically for this particular language-training approach. None of the items appear in any of the instructional programs; however, it is hoped that there will be generalization and transfer from the training to the test items. As Shulman (1966) has pointed out, while the insistence on behavioral

statements of objectives forces educators to think with extreme precision about the hoped-for outcomes, there is a danger that this emphasis on specifying behavior will restrict the scope of the instructional objectives. Courses thus become training in test-taking behavior. It should not be forgotten that the basic objective of instruction is to produce transfer to new situations and new tasks in which the trained skills are required.

Another approach to evaluation is being explored under a separate grant from the Center for the Study of Evaluation of Instructional Programs at UCLA. From this point of view, it would be important to measure the rate or efficiency of learning under different instructional procedures. All children will be given several days of instruction with the same materials, but using different pedagogical techniques. However, if the content is drawn from the universe of knowledge about the real world, children from different homes will have different types of previous experience. It has long been recognized in learning experiments with older subjects that association value, or meaningfulness, is an important confounding variable. The fact that certain learning occurs more readily under certain conditions, or with certain subjects, may be more closely related to the characteristics of the materials than to the nature of the instructor or the learners. To provide the controlled materials for a variety of learning experiments with young children, a repertoire of nonsense syllables and nonsense pictures of several measured levels of meaningfulness are being prepared and tested with a socio-economically representative population of children between the ages of four and six years.

There is no doubt that all these evaluation instruments neglect a number of affective variables which have a potent impact on the rate and nature of

learning. Among the most significant of these are impulsivity, motivation, and attention. Middle class children have already learned to value the praise and approval of adults. The effectiveness of these secondary reinforcers in controlling the behavior of children from low-income homes is not equally well established. Part of the task of an intervention program is to teach these children to obtain satisfaction from achievement in academic tasks both from their own sense of increased competence as well as from the contingent approval of adults (Temp, 1967). It is quite possible that many of the gains in I.Q. scores reported in evaluations of intervention programs are more a reflection of the fact that the child has learned to respond more appropriately to the examiner's expectations, as a result of reinforcements within the school situation, than any improvement in ability to perform the various tasks (Glick, 1966).

A major source of difficulty in evaluating instructional programs is that the instruments used are designed to measure individual differences rather than program effects on groups (Trismen, 1967). The use of a large pool of test items, as advocated by Cronbach (1957), would make it possible to construct a number of different tests to be administered to groups of children who have received a particular instructional procedure. For this item pool it would be quite appropriate to include at random items selected from the instructional material, as well as items over new material. A test of the objectives of both learning and transfer could thus be provided.

This procedure is particularly useful with young children who cannot sit through lengthy test periods. The test would not be a useful measure of the achievement of individual students, since each child would be tested only on one or two items over a wide variety of skills. Nor would they be useful for

comparing performance of children with others in the class, since each child in a particular class might be given a different set of items. However, a reliable basis for evaluating the total effect of the instructional program in achieving its stated objectives could be obtained by gathering data at random over a large number of children.

In closing, it might be appropriate to mention one of the most sticky of all evaluation problems, and one which most program evaluations tend to avoid. That is, how worthwhile are the goals which are being evaluated? Even if it can be proven beyond doubt that specific behavioral objectives have been achieved, is the learned behavior really important or relevant? Does improving the child's ability to discriminate environmental sounds and distinguish differences and similarities in geometric or pictorial visual forms actually lay a solid foundation for learning to read? Does exposing disadvantaged children to a variety of experiences, so that they can produce coherent stories about them in a limited, dialectical form, mean that these children can then use language to conceptualize, classify, and form schemata with which to integrate the data in the real world?

More fundamentally, most preschool intervention programs are designed to prepare disadvantaged children for entrance into the traditional middle-class kindergarten; in kindergarten, children are being prepared for first grade; firstgraders for second, and so on down the line. Preschool programs evaluated on this type of criteria are successful if they demonstrate that children who complete the program are therefore more likely to succeed in kindergarten, and even in first grade. But is this the ultimate goal? It is true that the UCLA Preschool Language Program has accepted "as expedient" the objective of success

in kindergarten and first grade. It is equally important to develop instruments to evaluate how well a particular curriculum achieves its stated goals. But this does not minimize the importance of at some point attempting to evaluate the goals themselves.

Footnotes

[1]Paper presented at Society for Research in Child Development, Biennial Meeting, New York, April, 1967.

[2]The major part of the research reported in this paper was performed under contract with the United States Office of Education, Department of Health, Education, and Welfare, Cooperative Research Program, Contract Number OE-5-85-045, and by the United States Office of Economic Opportunity, IED-66-1-12.

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Table 1. Sample Items from Echoic Response Inventory for Children.

Form A	Form B
1. Dogs bark.	1. Birds fly.
5. He pushed the door too hard.	5. He bounced the ball too high.
10. Quite a good show is playing.	10. Quite a large dog is barking.
15. If it's late, I have to hurry.	15. If it's late, he has to run.
20. If the ground is wet the children won't be able to play in the park.	20. If the weather is cold the children won't be able to swim at the beach.

Table 2. Sample Items from Expressive Vocabulary Inventory.

Item No.	Description of Picture	Question	Scoring Key Word
1.	fish	"What is this?"	"fish"
5.	boy swimming	"What's the boy doing?"	"swimming"
9.	cat in a box	"Where's the cat?"	"in"
33.	large and small ball	"This ball is smaller, what is this ball?"	"larger"
38.	circle and square	"This is round. What is this?"	"square"

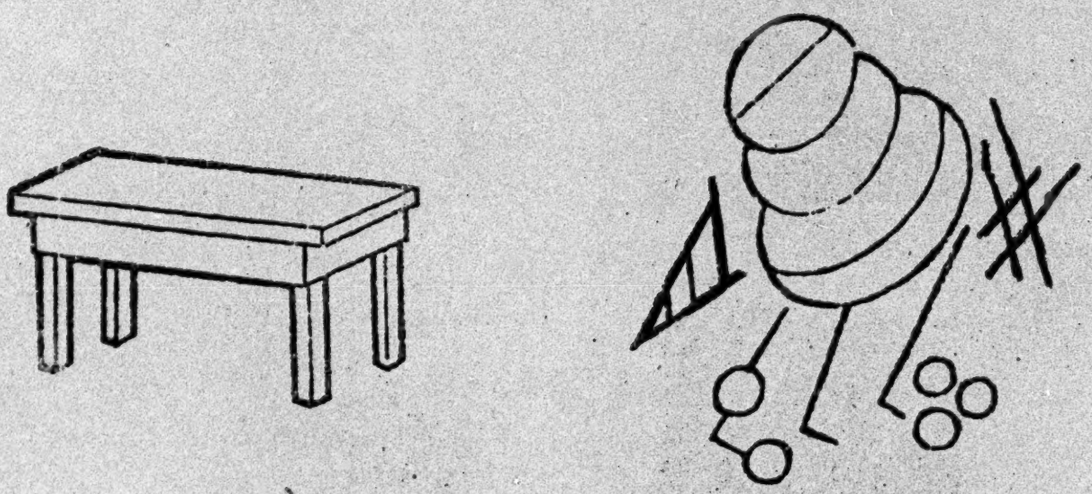
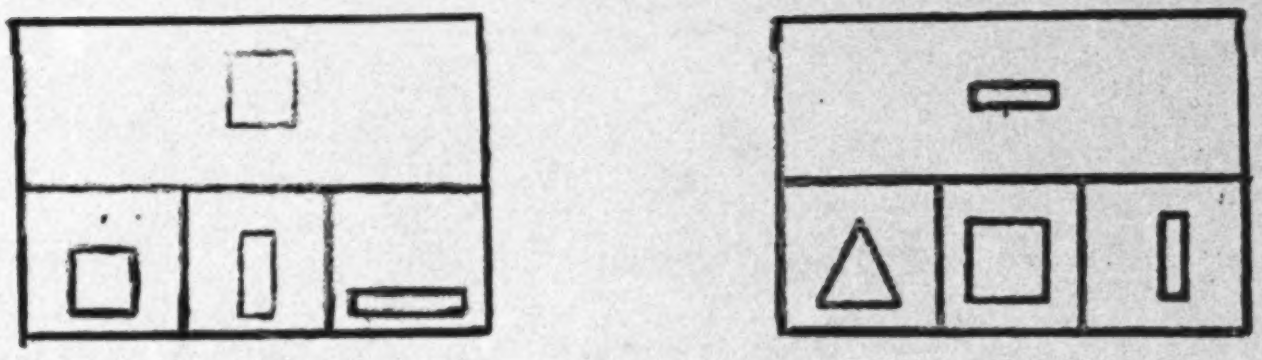


Figure 1. Sample Item from Children's Auditory Discrimination Inventory.



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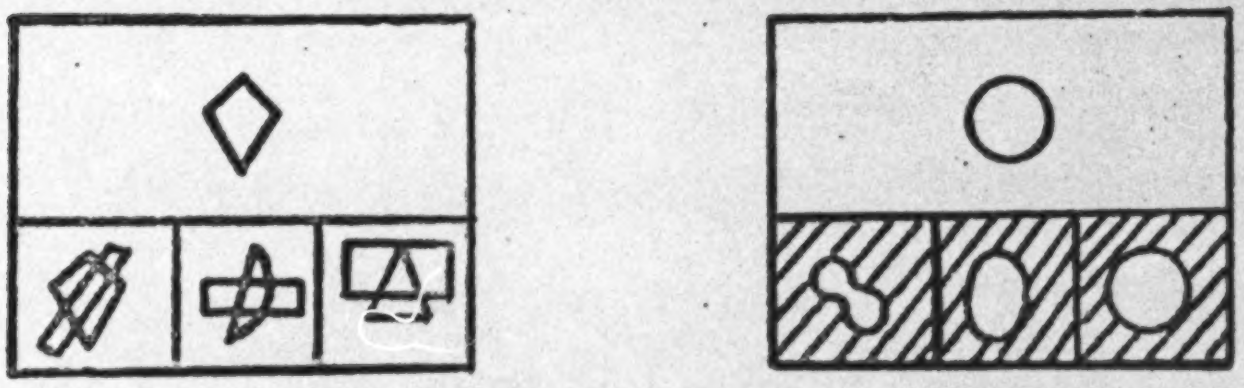
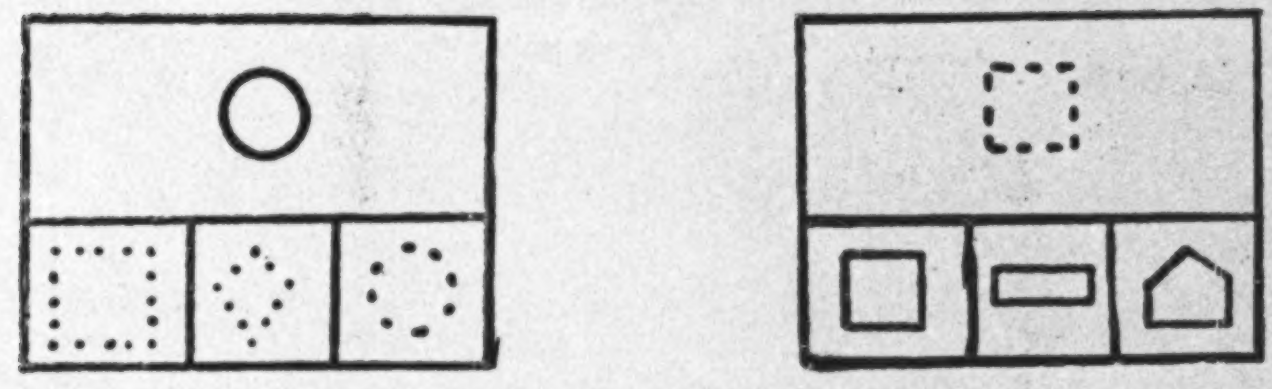
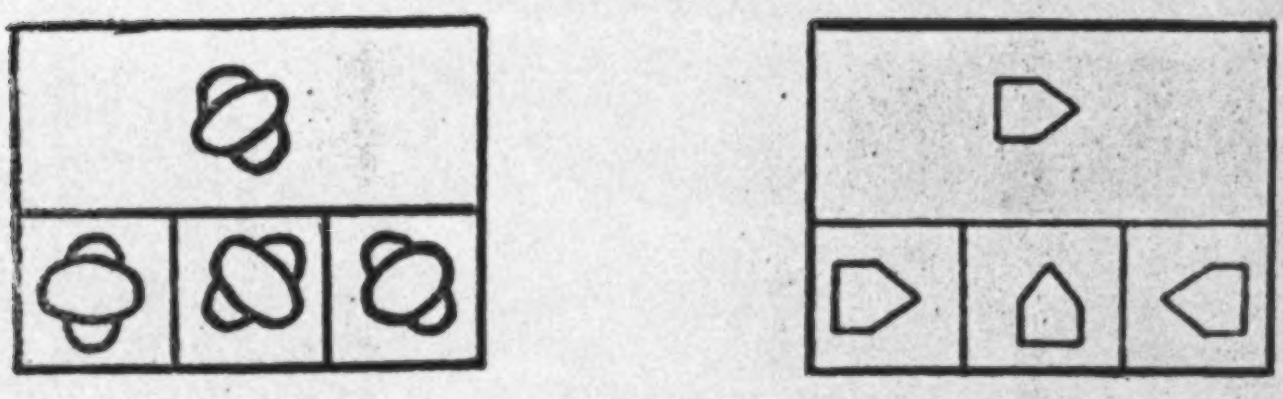


Figure Ground



Closure



Position in Space

Figure 2. Sample Item from Visual Discrimination Inventory.

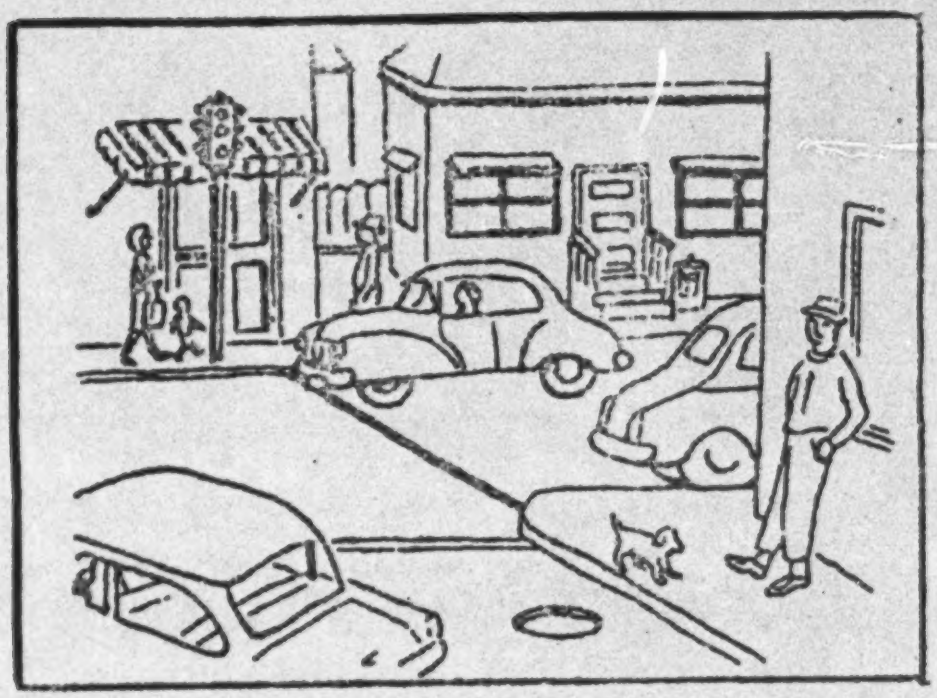


Figure 3. Sample Stimuli: Verbal Output Inventory for Children.

AN INSTRUMENT TO MEASURE VISUAL DISCRIMINATION OF YOUNG CHILDREN[1,2]

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A strong prima-facie case can be made for the relationship between visual discrimination ability and success in reading. The obvious need for the reader to make consistent and dependable responses to specific visual stimuli (graphemes) provides a persuasive logic for this widely held assumption. While reading, because of its basic role in all academic learning, is probably the most extensively studied subject in the curriculum, the literature is notable for the ease with which sweeping generalizations are propounded and accepted, with little support from experimental research. It is also notable for the large numbers of reports and articles deceptively decked out in the mini-skirt of experimental design.

William Gray has authored a series of reviews of research relating to reading dating back to 1925. He makes the statement that the accurate recognition of words involves a number of perceptual processes. Gertrude Hildreth (1950), an equally reputable reading specialist, recommended informal training in visual perception skills, with emphasis on matching and "looking", but on an experiential level rather than in a structured or formal workbook context.

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[1]This work is being supported by the United States Office of Education, Project Number OE-5-85-045, and the United States Office of Economic Opportunity, Project Number IED 66-1-12.

[2]A preliminary version of this research was presented at the American Psychological Association Annual Meeting, Washington D.C., September, 1967.

This generalized perceptual training approach is supported by Anderson and Dearborn (1952) and Bond (1960). More recently, Arena (1965) recommended training in visualization and motor skills as remediation for "more subtle language problems." Delacato (1963) bases his entire system of reading instruction on the early acquisition of perceptual-motor skills.

In recent years, the emphasis on conducting learning research in the school setting has stimulated a great many studies, a large proportion of which have little claim to objective validity. Even experiments which maintain careful controls, however, produce conflicting results. Hillerich (1964) found that formal workbook training in pre-reading skills in kindergarten produced better readers at the end of the first grade, whereas Goins (1958), Ploghoft (1959), Gorelick (1962), and Fry (1965) found that children who had used readiness workbooks during kindergarten did not have greater success in beginning reading than children who had had unstructured readiness experiences.

Many pre-kindergarten programs today are placing great emphasis on "same-different" discrimination training in both auditory and visual modalities, although McKee (1948) had found that such exercises were not useful in developing word recognition. Instead, he demonstrated that the best way to improve word recognition was to provide drill in word recognition. Both King (1963) and Popp (1964) have obtained results which seem to support the position that training in discriminating letters and words does improve the ability to make such discriminations within a reading context.

While Dunn (1965) maintains that visual perception is more important than vocabulary in predicting ease of learning to read, Ashlock (1963) could find no support for a relationship between visual perception and reading in terms of either the task or the content of the training materials. However, it was found that the importance of visual perception skills in predicting levels of

reading achievement decreases with age. This may very well reflect the age-related changes in visual perception reported by Elkind, Koegler, and Go (1964), and Braine (1965.)

Although a strong correlation between reading and intelligence is well-established, the relationship between visual perception and intelligence is still unclear. Allen, Haupt, and Jones (1965) found low correlations between visual perception and the spatial-visual subtests of the WISC. Birch and Belmont (1964, 1965) noted that whereas the correlation between I.Q. and reading increased with age, this was not true with tests of auditory-visual integration. These investigators speculated that this may be due to the low ceiling of the auditory-visual integration test, or that the perceptual skills might be most important for initial acquisition whereas later reading emphasizes comprehension, which is more closely related to intelligence. Still another interpretation may be drawn from the work of Abravanel (1966) which indicated that performance on a "same-different" task did not approach asymptote level until about five years of age.

Gibson and Olum (1960) report a finding by Hemmendinger that young children respond globally to Rorschach ink blots at the age of three, increase their attention to details at about six or seven, and integrate parts into wholes at the age of nine or ten years. Gibson and Olum take the position that the perceptual factor in learning to read is closely related to the ability to discriminate meaningless or abstract forms. This type of reasoning provides the rationale for extensive use of matching exercises in "reading readiness" workbooks.

A major and critical problem in most studies of perceptual discrimination in young children is the inadequacy of criteria or instruments for measuring this ability. The most commonly used tests are Bender (1938), also Koppitz, (1964), Frostig (1964), and Winterhaven (1966). All of these, however, con-

found eye-hand coordination with perceptual discrimination skill. A new test developed by Rosenberg (1966) avoids this criticism by employing a pointing or selection response, but the highly structured and abstract stimuli have little intrinsic interest for the young child. In addition, there is no attempt to get at different types of discrimination tasks.

The test most frequently used for the assessment of visual discrimination with young children is the Frostig Developmental Test of Visual Perception. It is based on a delineation of five hypothetically distinct areas: eye-hand coordination, figure-ground, form-constancy, position-in-space, and spatial relationships. Age norms for children between the ages of three and nine are available. The use of this instrument with children demonstrating dyslexia as well as other learning disorders has yielded dependable correlations.

On the basis of this relationship (a "post-hoc, propter hoc" fallacy) a number of studies have investigated the value of using a training program especially prepared by the Frostig school for the remediation of perceptual deficits. Cohen (1966) and Arciszewski (1967) used these materials in training programs and found improved performance on the Frostig test, but no improvement in reading. Olson (1966) found a significant correlation between the Frostig training materials and the vocabulary subtest of the California Achievement Test, but there was no significant relationship with the Gates Word Recognition Test. Olson found only one dependable correlation, that between position-in-space and reversible-words-in-context ($r = .386$).

In the studies cited, where the children are in the elementary grades and can perform the motor tasks on which the tests are based, there seems to be no problem with the existing measures of visual discrimination. However, at this level the best experimental evidence indicates that providing remedial discrimination training for children who obtain low scores on such tests is not the

most efficient method of producing improvement in reading skills. If the goal is increasing the child's ability to discriminate letter and word forms and to associate auditory responses with visual stimuli, it is far more effective to provide direct practice with the relevant materials.

However, for the very young child, especially those from disadvantaged homes where opportunities to use paper-and-pencil are exceedingly limited, the available instruments for the measurement of visual discrimination are not appropriate. This statement is supported by data obtained by the authors, using the Frostig with a group of 17 four-year-old children, eight from a low socioeconomic group and nine from a middle socioeconomic group. For the first group, no child scored above the 20th percentile according to the Frostig norms. All the highly advantaged nursery school children, who had had considerable experience in similar tasks, scored below the 58th percentile. Three features of the test seemed to be most important in producing these results. 1) The language in which the tasks are presented tended to confuse rather than instruct. 2) The test took, on the average, about 40 minutes to administer and most of the children lost interest about half way through. It is of course possible to avoid this difficulty by administering the test in two parts on separate occasions, but this would not be consonant with the instructions in the test manual. 3) The use of different colors for marking was not only confusing, but also served to distract children from the task since there was a general tendency to use the colors in drawing pictures.

If there is predictive as well as face validity to the hypothesis that visual discrimination skills are important prerequisites to beginning reading, a way of measuring this skill in young children, without the confounding variables of motor skill, task comprehension, and experience with paper-and-pencil activities, must be developed. The present paper is a report of the construction of one such instrument, as a first step in a more comprehensive study of

variables affecting children's ability to learn to read.

Method

Rationale and Description of Test

The UCLA Discrimination Inventory (VDI) consists of 52 items in four subtests: figure-ground, form-constancy, closure, and position-in-space. These subtests are designed to measure separate aspects of visual discrimination, each of which has been assumed to represent prerequisite skills important in learning to read. For instance, figure-ground may relate to the ability of a child to recognize familiar letters in new words; form-constancy seems to be prerequisite to identifying letters presented in different sizes, such as upper and lower case; position-in-space may be involved when children read "b" as "d" or "p" as "q"; and closure in the process of integrating letters into words. It is important to remember that these are hypothetical assumptions which must be subjected to empirical exploration.

The test can be presented to groups of children, takes approximately 15 minutes to administer, and very little time to score.

The test items consist of 8 1/2" x 11" frames (sheets of paper encased in plastic page protectors) with black-and-white drawings. (See Figure 1 for sample items.) Each frame contains a model in the center of the top

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Insert Figure 1 about here

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half of the page and alternatives in three boxes across the lower half of the page. The task for the child is to select the one of the three alternatives which is most like the model.

Test Forms

In the preliminary work, there seemed to be a tendency for children to

select the middle picture when the discriminations became too difficult. To estimate the effect of this position bias, as well as that of right-left preference, three forms of the test were constructed. In each form, the correct answer was in a different box. Thus, if in Form A the correct picture was the left alternative, in Form B it might be in the middle box, and in Form C the right-hand box. The three forms were randomly presented over the total population.

Subjects

All the children, (291) between the ages of 3-0 and 5-11 in seven Day Care Centers and four private nursery schools were tested. There were 139 boys and 152 girls, including 199 Negro and 92 Caucasian children, from two levels of economic status. Two measures of mental ability, the Peabody Picture Vocabulary and the Goodenough Draw-A-Man Test, were administered.

Procedure

All tests were individually administered in a small anteroom, if available, or in a screened corner of the regular classroom. The child was asked to point to one of three pictures which corresponded to a model. However, when the first item with which the child was confronted showed the model on the same page as the alternatives, many children pointed to this picture when asked to find "another one" like it rather than to the one of three alternatives which was most like the model. Task training was therefore necessary. It began by presenting the model on a separate card and gradually moving it into position in the center of the top half of the frame. If the child did not respond correctly to six consecutive items, the task-training program was repeated. The VDI was administered to children only after they had reached criterion on the basic task instructions.

Table 1 presents the mean scores on the total 52 item UCLA Visual

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Insert Table 1 about here

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Discrimination Inventory for 291 children, by sex, race, two levels of socioeconomic status, and three levels of age (3, 4, and 5 years). Since the test involves a three-choice selection, a score of 17 can be obtained by chance. Even the lowest mean score reported is significantly above this level.

The uneven distribution of subjects within the 24 cells determined by the 2 x 2 x 2 x 3 design would have provided too few cases in several of these cells; therefore two separate 2 x 2 x 3 analyses of variance were computed. A principal objective of the first analysis (Table 2) was to

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Insert Table 2 about here

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determine whether any significant difference in visual discrimination could be attributed to sex, within age and race groupings. An F of .2 with almost 300 cases provided assurance that, contrary to a number of studies which report important sex differences, there was little likelihood that boys would differ significantly from girls in their performance on this type of task. Whatever the factors that produce more beginning reading problems in boys than girls, they are probably not integrally related to the ability to make appropriate visual discriminations. In the same analysis, significant differences (.01 level) were found for both age and race, although no interaction effects were dependable.

The second analysis of variance (Table 3) was concerned with the

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Insert Table 3 about here

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main effect of socioeconomic status, again within age and race groupings. While the F of 3.4 approaches significance, it is not sufficient to disprove the null hypothesis that differences in visual discrimination are not related to socioeconomic status. However, the main effects of race and age were verified, with again no interaction effects supported. A Newman-Keuls analysis shows that main effect differences are primarily attributable to the lower scores of the three-year-old and Negro children in the lower SES groups.

Of the 291 children, 161 were given the Peabody Picture Vocabulary and the Goodenough Draw-a-Man Test. The relationship among these measures and the VDI, as well as the relevant means and standard deviations, are presented in Table 4.

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Insert Table 4 about here

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As indicated earlier, three forms of the VDI were used to control for the effects of position preference. Intra-form reliability for the four subtests and the total test are presented in Table 5. Using Horst's re-

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Insert Table 5 about here

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vision of the Kuder-Richardson Formula 20, total test reliabilities of .90 to

.92 were found for the three forms. When data for items across forms are summed, the K-R reliability coefficient is .88. The Spearman-Brown prophesy formula for the same data produces a reliability estimate of .91.

Discussion

Although the design of the present investigation anticipated differences in performance due to sex, age, race, and socioeconomic status, the data presented in Tables 1 through 3 indicate that primary differences are attributable only to age and race. According to a Newman-Keuls analysis, the performance of all three-year-old children does not differ significantly as a function of sex, race, or SES. Also, within these groups, particularly with Caucasian children of either high or low socioeconomic status, performance at ages four and five are not significantly different; it is between the ages of three and four that major changes seem to take place. This is in line with other studies which demonstrate that visual discrimination skills attain almost maximum development by the 5th to 7th years.

With Negro children, high SES groups show gradual growth from the third to the fifth year; the low SES children have very meager gains and at the fifth year are still not significantly superior to the average three-year-old Caucasian child. This evidence provides additional support for the "cumulative deficit" which characterizes disadvantaged children in so many areas related to academic performance. If this difference is found between nursery and day care populations, where there is a considerable degree of overlap, it suggests that more severely disadvantaged children will demonstrate even greater deficits. It is highly likely that an analysis including data from Headstart classes would show significant main effects for socioeconomic status.

A number of studies have indicated that there is a positive, albeit weak, relationship between intelligence and visual discrimination. In Table 4 the correlations of the VDI with the Peabody and the Goodenough support this finding. However, the data of the present study show that Caucasian high SES children have significantly higher correlations between the VDI and either of the measures of mental ability than do the Negro low SES children. It is also worth noting here that the advantaged groups obtain higher scores on the PPVT, which is a test of verbal ability, than they do on the Goodenough, with the reverse true for the disadvantaged children. Evidently, while superior verbal ability usually accompanies high scores on the VDI, the discrimination task seems to tap a type of ability which is not necessarily tied to conventional measures of intelligence.

In establishing the usefulness of any instrument, data concerning validity and reliability are of paramount importance. At the present stage of its development, the UCLA VDI has established considerable construct validity, as evidenced by the subtest reliability. It also has a high level of face validity, based on traditional, commonsense association of certain reading subskills with ability to respond appropriately to differences and likenesses in visual stimuli. A more critical type of validity relates to an instrument's ability to predict performance on a criterion measure. A study is now being planned to obtain a measure of predictive validity, using performance in beginning reading as one important criterion.

With reference to reliability, several measures have been computed and reported in Table 5. The values obtained are sufficiently high to engender confidence in the instrument, especially considering the fact that the population tested is a comparatively homogeneous one.

To summarize, the use of the UCLA instrument has demonstrated its usefulness in identifying a range of ability in visual discrimination with several population groupings. Additional work is now being done to develop the four subtests as measures of component elements of a broad visual discrimination ability.

Large pools of items are being administered over a broad population of children. The data will then be subjected to factor analysis to identify the most sensitive items and those which have minimum overlap. It is expected that a strong and reliable measure of visual discrimination, which can be used with young children from a wide range of socioeconomic backgrounds, will be developed. It is hoped that this type of measure, given as a routine test at the kindergarten or first grade level, will identify children who may be expected to demonstrate a wide variety of problems in dealing with the environment. Of major importance will be the potential ability to predict cases of incipient dyslexia, as well as other learning disorders, before they have become severe enough to be obvious to the classroom teacher.

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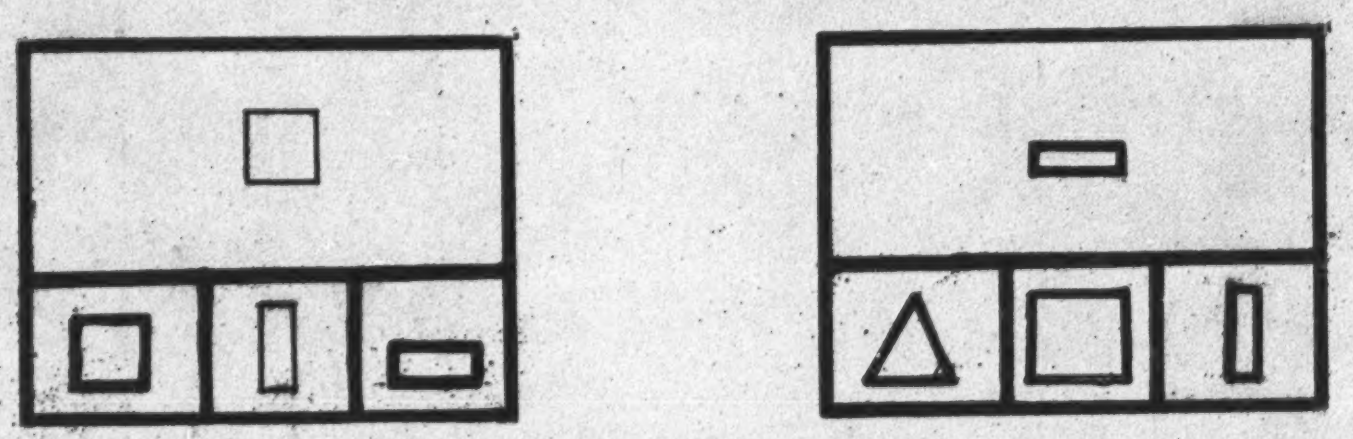


FORM CONSTANCY

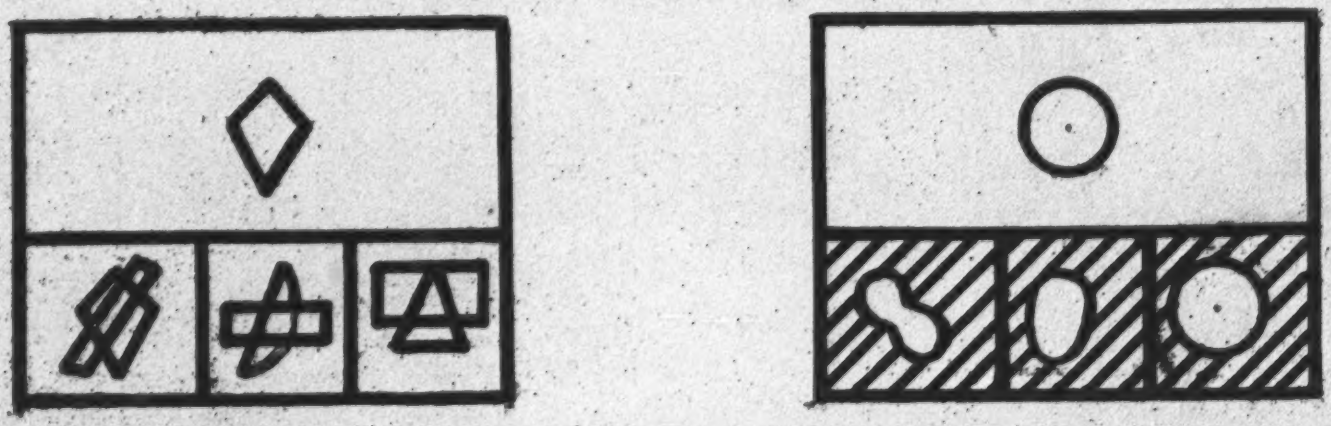
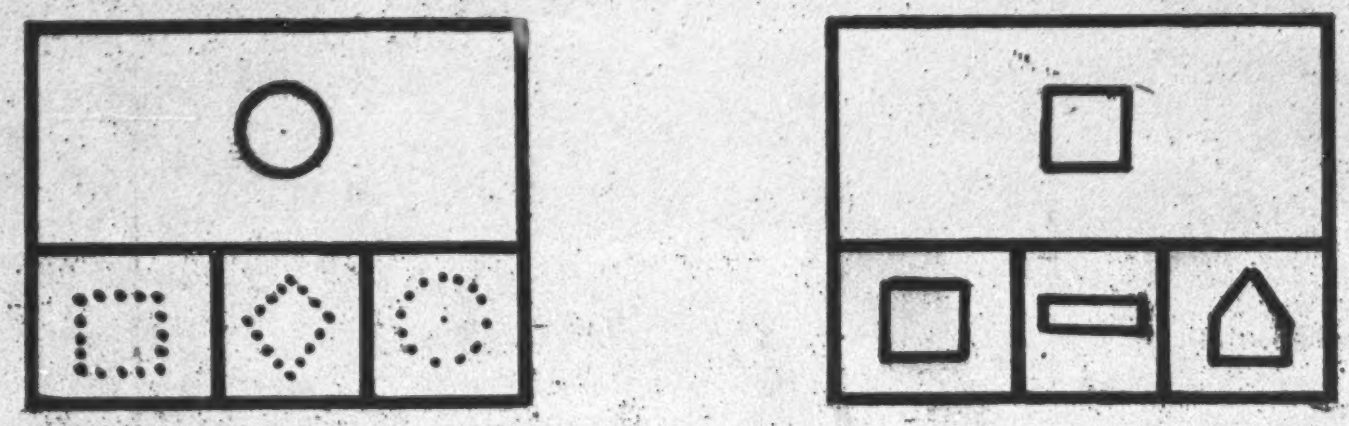
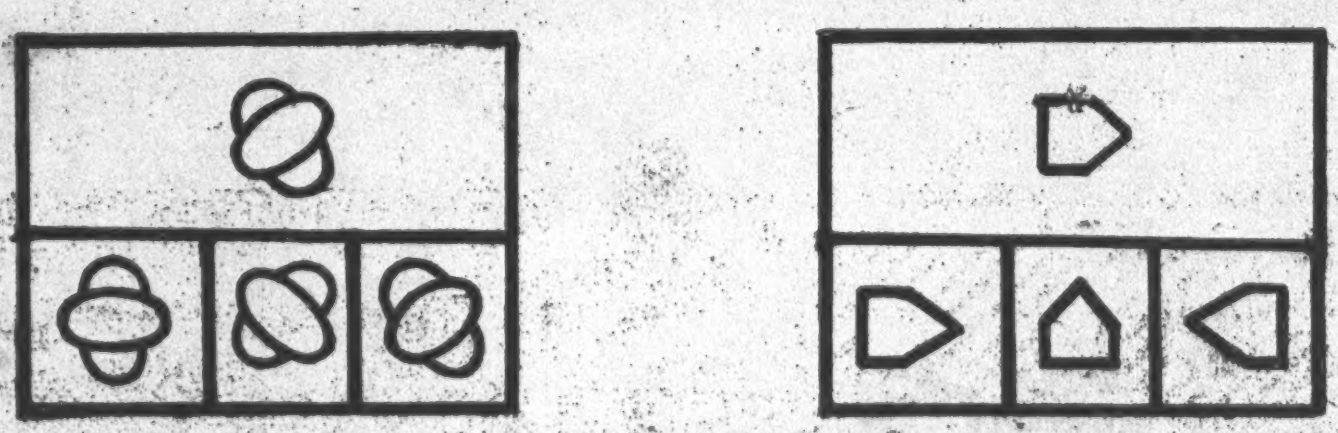


FIGURE GROUND



CLOSURE



POSITION IN SPACE

Figure 1. Sample Items for V.D.I.

Scores on VDI by Ethnic Group, Age, Sex, and Socioeconomic Status

	N	THREE YRS. OLD		N	FOUR YRS. OLD		N	FIVE YRS. OLD		N	TOTAL YRS. OLD	
		M	SD		M	SD		M	SD		M	SD
High Negro Boys	10	27.2	4.8	6	30.5	5.7	5	33.8	5.8	22	29.1	6.2
High Negro Girls	7	25.4	3.5	7	33.0	4.0	4	37.8	7.3	17	30.6	6.5
Low Negro Boys	9	28.9	7.5	27	28.7	5.0	39	29.6	8.8	75	29.2	7.4
Low Negro Girls	22	24.0	9.4	28	28.1	4.4	35	31.5	9.3	85	28.5	8.5
Total Negro Boys	19	28.0	6.1	34	28.8	5.4	44	30.1	8.6	97	29.2	7.1
Total Negro Girls	29	24.3	8.4	34	28.8	4.4	39	32.1	9.2	102	28.8	8.2
Total Negro	48	25.8	7.6	68	28.8	4.9	83	31.0	8.9	199	29.0	7.7
High Cauc. Boys	12	28.5	6.7	17	33.7	7.0	2	37.0	5.7	31	31.9	7.2
High Cauc. Girls	15	28.7	5.2	18	39.0	5.8	6	36.2	9.3	39	34.6	7.8
Low Cauc. Boys	1	24.0	0.	7	34.3	6.3	3	41.0	7.8	11	35.2	7.7
Low Cauc. Girls	1	28.0	0.	4	32.5	7.4	6	31.7	11.7	11	31.6	9.3
Total Cauc. Boys	13	28.2	6.5	24	33.8	6.6	5	31.4	6.6	42	32.7	7.4
Total Cauc. Girls	16	28.6	5.1	22	37.8	6.5	12	33.9	10.3	50	33.9	8.1
Total Cauc.	29	28.4	5.7	46	35.7	6.8	17	35.5	9.5	92	33.3	7.8
Total High Negro	17	26.5	4.3	13	30.1	5.7	9	35.6	6.4	39	29.8	6.3
Total Low Negro	31	25.4	9.0	55	28.4	4.7	74	30.5	9.0	160	28.8	8.0
Total High Cauc.	27	28.6	5.8	35	36.4	6.9	8	36.4	8.2	70	33.4	7.6
Total Low Cauc.	2	26.0	2.8	11	33.6	6.4	9	34.8	11.0	22	33.4	8.5
Total High SES	44	27.8	5.3	48	34.7	7.1	17	35.9	7.1	109	32.1	1.3
Total Low SES	33	25.5	8.8	66	29.3	5.3	83	31.0	9.3	182	29.4	8.2
Total -	77	26.8	7.0	114	31.6	6.7	100	31.8	9.1	291	30.4	7.9

Table 2

Analysis of Variance (Race x Sex x Age)

Source	df	MS	F
Race (A)	1	1253.3	23.8**
Sex (B)	1	9.0	.17
Age (C)	2	778.6	14.8**
A x B	1	0.31	.01
A x C	2	127.5	2.4
B x C	2	96.45	1.8
A x B x C	2	158.2	3.0
$Error_w$	279	52.6	

** $p < .01$

Table 3

Analysis of Variance (Race x SES x Age)

Source	df	MS	F
Race (A)	1	310.7	5.8*
SES (B)	1	179.9	3.4
Age (C)	2	484.3	9.09**
A x B	1	0.5	.01
A x C	2	62.8	1.2
B x C	2	6.1	.11
A x B x C	2	21.31	.40
$Error_w$	279	53.3	

* $p < .05$

** $p < .01$

Table 4

Correlations on UCLA Visual Discrimination Inventory with Goodenough Draw-a-Man Test and Peabody Picture Vocabulary Test by Race and SES

Group	N	VDI		DAM			PPVT		
		M	SD	M	SD	r	M	SD	r
Negro	78	27.7	6.7	48.2	10.6	.21	41.7	10.9	.25
Caucasian	83	33.2	7.4	51.5	14.5	.58	59.6	14.2	.55
High SES	70	33.4	7.6	51.3	14.9	.68	61.4	14.6	.59
Low SES	91	28.4	6.9	48.9	11.0	.19	42.8	10.7	.28

Table 5

Total and Subtest Reliabilities Based on Population of 112 Children from Low Socioeconomic Group Only (Combined Race and Age)

Test and Subtests by Forms	N	M	SD	K-R 20[1]
Total Test (52 Items)				
Form A	36	30.1	8.8	.90
Form B	38	32.1	9.2	.92
Form C	38	31.0	8.4	.90
Figure-Ground (13 Items)				
Form A	36	8.9	3.4	.88
Form B	38	9.3	2.3	.71
Form C	38	8.0	3.0	.85
Form-Constancy (13 Items)				
Form A	36	7.5	2.6	.71
Form B	38	8.0	2.5	.71
Form C	38	7.6	2.4	.62
Closure (13 Items)				
Form A	36	6.8	2.3	.69
Form B	38	7.9	2.8	.82
Form C	38	6.7	2.4	.77
Position-in-Space (13 Items)				
Form A	36	6.9	2.4	.64
Form B	38	6.7	2.9	.85
Form C	38	7.7	2.9	.86

[1]Horst's revision.

ABSTRACT

Tests of visual discrimination which usually involve eye-hand coordination, produce scores which may confound motor skill with visual discrimination ability. To avoid this problem, a test which requires a selection rather than a drawing response has been developed at UCLA. There are 52 items, 13 in each of 4 categories: form-constancy, figure-ground, closure, and position-in-space. The test was administered to 291 children, Negro and Caucasian, in 3 age groups (3, 4, and 5) and 2 levels of socioeconomic status. Two measures of internal consistency, Spearman-Brown r = .91 and Kuder-Richardson r = .88, indicate an acceptable level of reliability. Analysis of variance showed significant main effects for age and race. Low positive correlations with mental age indicate a minimal intelligence component. The test should prove valuable for assessing a skill usually associated with beginning reading.

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